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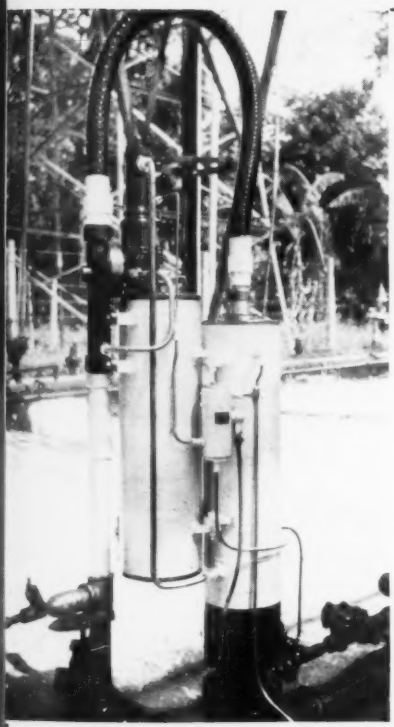

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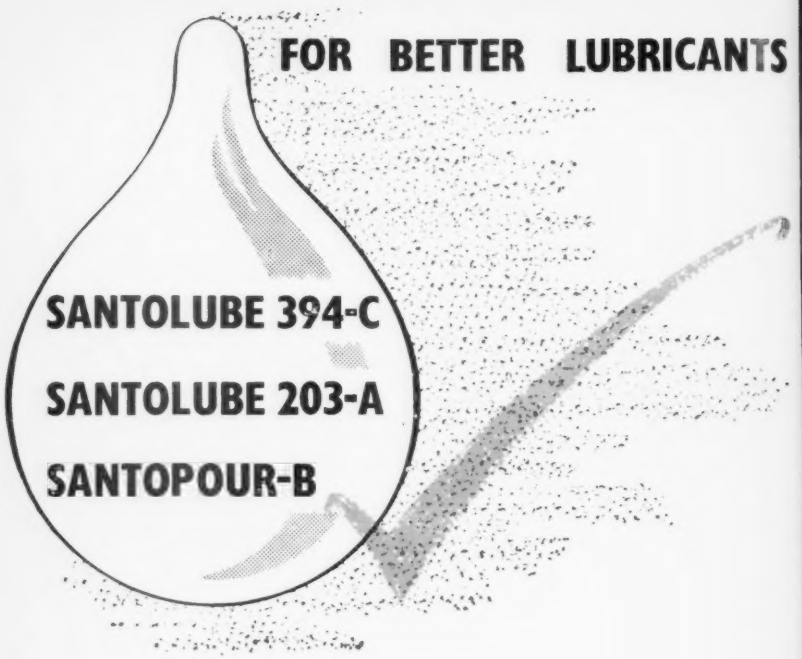

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THE ANNUAL DINNER

The expanding influence of the Institute of Petroleum was reflected in the distinction and the numbers of its guests and members on the occasion of its Annual Dinner at the Savoy Hotel, London, on February 28, under the presidency of Mr E. A. Evans, M.I.Mech.E., F.R.I.C.

The company numbered nearly 500. The principal guest was the Right Hon. Lord Llewellin, P.C., C.B.E., M.C., T.D. Sir Frederick Godber (*Shell Transport and Trading Co.*) and Sir William Palmer, K.B.E., C.B. (*Oil Consumers' Council*) were among the official guests, who included also W. E. Abraham (*Burmah Oil Co. Ltd.*), B. Barnes (*Ministry of Fuel and Power*), R. A. Carder (*Anglo-American Oil Co. Ltd.*), J. M. Cooper (*Kuwait Oil Co. Ltd.*), Dr Roxbee Cox (*Ministry of Fuel and Power*), D. G. Duff (*Ministry of Fuel and Power*), Lt-Col. H. S. Ebben (*Manchester Oil Refinery Ltd.*), Sir H. B. Heath Eves (*Anglo-Iranian Oil Co. Ltd.*), The Rt. Hon. The Viscount Falmouth, Sir D. Fergusson, G.C.B. (*Ministry of Fuel and Power*), The Rt. Hon. Lord Forres (*Lobitos Oilfields Ltd.*), Dr H. M. Glass (*British Standards Institution*), Major K. Gordon (*Trinidad Leaseholds Ltd.*), J. C. Gridley (*Vacuum Oil Co. Ltd.*), Sir K. B. Harper (Burmah *Oil Co. Ltd.*), E. F. E. Howard (*Council of British Manufacturers of Petroleum Equipment*), A. Limb (*Messrs C. C. Wakefield and Co. Ltd.*), Sir Alexander McColl (*Vacuum Oil Co. Ltd.*), C. M. Merrick (*Shell-Mex and B.P. Ltd.*), L. Migaux (*Association Française des Techniciens du Pétrole*), Vice-Admiral A. H. Packer, C.B., C.B.E. (*Fourth Sea Lord*), Dr A. Parker (*Fuel Research Station*), R. W. Quirk (*Ministry of Fuel and Power*), B. G. Robbins (*Institution of Mechanical Engineers*), A. Robens (*Ministry of Fuel and Power*), S. Robson (*Society of Chemical Industry*),

The President, with Lord Llewellin (left) *and Sir Frederick Godber* (right).

Prof. H. E. Shortt, C.I.E. (*Royal Society of Tropical Medicine and Hygiene*), L. Sinclair (*Anglo-American Oil Co. Ltd.*), C. A. P. Southwell, M.C. (*Kuwait Oil Co. Ltd.*), Dr D. T. A. Townend (*Institute of Fuel*), R. E. F. de Trafford (*Manchester Oil Refinery Ltd.*), S. J. Vos (*Trinidad Leaseholds Ltd.*), and Dr A. E. Watson, O.B.E. (*Institution of Mechanical Engineers*).

Among the members of Council present were Lt-Col. S. J. M. Auld, O.B.E., M.C., T. Dewhurst, and Prof. F. H. Garner, O.B.E. (*past-presidents*); M. A. L. Banks, E. J. Dunstan, Dr E. B. Evans, H. Hyams, and J. S. Parker (*vice-presidents*); V. Biske, C. D. Brewer, C. T. Brunner, F. L. Garton, H. S. Gibson, C.B.E., H. E. F. Pracy, R. B. Southall, E. J. Sturgess, H. C. Tett, G. H. Thornley, and A. T. Wilford.

"The Institute of Petroleum"

The **Rt. Hon. Lord Llewellin,** P.C., C.B.E., M.C., T.D., proposing the toast of "The Institute of Petroleum," said:

"It is a delightful duty to propose the toast of 'The Institute of Petroleum,' because it is always pleasant to talk about something which is good.

"Although the days of 'institutions' are of the past, we are now in the days of institutes. There was a time when, if an old person had to be cared for, everyone said he had gone to the 'workhouse'; later, when it was more euphemistically named, they said he had gone to the 'institution.' Nowadays, it is the institutes that have become the workhouses, the places where the really important work is done by professional men such as yourselves, by scientists, engineers and, I am told, a certain number of economists—a race of mankind which, I frankly admit, I rather distrust (laughter). It is through institutes like yours that progress is made.

"Great strides have been made in your industry during the present century. New oilfields have been found, quite largely, I understand, by those who have studied geophysics; new methods of drilling have been invented; thousands of miles of pipeline have been laid; tankers have been greatly improved; refining methods have been greatly im-

proved; and the old method of 'rolling out the barrel' has been dispensed with, except for alcoholic beverages."

Lord Llewellin recalled a meeting in 1938, at the time of Munich, when he was chairman of the Oil Board. His duty was to tell the large oil companies that it was necessary to pool their products as it was very likely that within a week we might be at war. It was true that war did not come for another year; but none thought then that, eleven years afterwards, we should still have Pool petrol—and not enough of that. Let us hope, he said, that by really pushing ahead with the completion of more refineries we shall soon get back to more ample supplies. The technical men concerned with these projects were doing a great service to their fellow countrymen, and were counteracting to a certain extent the feeling that experts were a menace to mankind.

The last war would have been a much more pleasant one if the internal combustion engine had never been invented and petroleum had never been discovered! There would have been no dive-bombers, no tanks, no collapse of France, no dashing backwards and forwards across North Africa, nothing to carry the bombs that were hurled at our factories and homes, no doodlebugs and, for him personally, none of the frightful problems he had to deal with as Minister of Aircraft Production; and in the future there would be nothing to carry those new great menaces, the atom and the hydrogen bombs, across almost indefensible air frontiers.

Yet, looking at the other side of the picture, it was the experts who, by producing the 100-octane fuel for the Merlin engines, enabled the Battle of Britain to be won. It was they, in turn, who enabled our airmen to pulverize German production, to run pipelines from the Bristol Channel north and east, and to the Isle of Wight; who made PLUTO possible; and who provided the fuel for our tanks and armoured cars and enabled us finally to attain victory in Europe.

"Therefore," he said, "so long as other nations have menacing men such as yourselves, let us have them too. It is only so that we can progress; it is only so that we can have peace."

Lord Llewellin said it gave him great pleasure to associate the name of the President with the toast and recalled the time Mr Evans organized an air pageant at Hayes and induced him to go up in the flimsiest aeroplane he had ever seen, with a woman pilot. At that time he had had no experience of the wonderful work that women did in the Air Transport Auxiliary. But in a flimsy 'plane, piloted by a woman, he went up from a very small field, entirely because of the initiative, the drive, and the persuasion of Mr Evans. Concluding, Lord Llewellin said: "I am quite certain, too, that under your charming leadership and with your drive and initiative this Institute will itself rise to even greater esteem and greater stature than that which it at present enjoys. May every one of you always experience very happy landings."

Among the Ministry's representatives were Dr Roxbee Cox (Chief Scientist), A. Robens (Parliamentary Secretary) and R. W. Quirk.

The President's Reply

The President, in responding, said: "We are very appreciative of the delightful manner in which Lord Llewellin has addressed us, which clearly indicates that he gets consider-

able personal pleasure in awarding words of praise and encouragement to honest and simple folk—simple only in the respect that we do like to keep a strict fidelity to nature who, after all, in petroleum, has provided us with a substance which is more magnetic to politicians than any other material in the world. However assiduously the mere politicians have examined its importance, it goes on attracting even the biggest statesmen, but whatever conclusions they reach, petroleum just glides along, either with dollar aid, or without it, until it reaches Greenwich Mean Meridian, when all is still and its spirit gone. Even Fuel and Power cannot get the petroleum spirit back from the Cabinet! (laughter).

"In the swift advance of technology, which has run ahead of economics, whose progress must be more gradual than revolutionary, workers in the petroleum field have often had to reconstruct a scientific edifice from its base. In the effort, the experimental work has plunged some into disappointment. Others, who have found nutriment in petroleum and flourished on it, have had great success, success which will long be remembered. But, we do not want our past achievements to hang like medallions in our memory's chamber. It is what we are doing or about to do

that matters. When we think otherwise it is getting time to be tenderly chloroformed into a better world.

"I do not want to over-emphasize our enthusiasm, because I know that enthusiasm can be very wearying; in fact, I am now beginning to understand why prophets were unpopular in Judea, where they were best known. But, we just cannot hide the saints of science, which humanity treasures. It is hardly necessary to remind you that the producer and the scientific staff are the two pillars upon which rests the massive, ornamental and strangely complex arch of commerce.

"However perfectly this structure may be designed and proportioned, it cannot always be certain of escaping that monstrousness which nearly enveloped the Institute of Petroleum recently—money. Happily, the Institute did not

descend into the desolate abyss of poverty, but it became quite clear that it must be provided with a new roof of security. Even if we cannot say that luxury has arrived we can say that comfort is now certain, and there are indications of better things to come. If recovery is certain, it can be slow if it likes.

"To all those industrialists who have helped us we now proudly proclaim our gratitude. They realize that if we are always necessitous we cannot fulfil the purpose of our Institute, possess dignity or credit, confidence at home, or respectability abroad.

"It is well known that all important affairs are discussed at feasts; so this evening I must warn you that before the lapse of many years we shall be compelled to find a new home for ourselves, unless our landlord is very

charitable! We all know what little accommodation we have, and that the lease on our premises is a short one. Some of you may wonder what we intend to do about it. Obviously, we do not want to keep your curiosity in perpetual motion. Whilst we wish to exalt the timorous to confidence, we must view the subject with judical calmness. Certainly we do not want a burdensome loan.

"It may be that bachelors, and perhaps childless widowers, would regard the Institute as an excellent depository for unattached fortunes or legacies. They could escape death duties if they gave us the money seven years before they died! Should they have a disorder which is growing daily worse they should not procrastinate, as doctors are stated to be not what they were. Perhaps this is nothing to worry about; it is just the 'state' they have got into!

"To those who have strengthened, and will continue to strengthen the Institute of Petroleum, I must say that so long as we have a real and direct effect upon the minds of men, and go on creating and stimulating new thoughts, we shall play an important part in the history of our race.

"Now, I should like to remind our Corporate Members that by becoming members they have entered into a contract involving our predecessors and successors, and our status—a contract not lightly to be entered into, as we pride ourselves on a continuous procession of prudent generations. There are still a few very able people in the petroleum industry who are eligible for corporate membership who have not joined us. To them I must say that we are no mystery-mongering body. We are governed by a Council which has too noble a nature and too elevated a mind to permit itself to admit unworthy persons into our midst, or practices which are distasteful to a professional status. In the Council we have a wise and equitable administration.

"Although I lack the resounding style of a salesman, I should like to say in happy and facile language, in the presence of so general and so powerful a display of leaders of industry, that we admire their general dignity which no small man can ever attain. We acknowledge with pride that our trade will always be our protection even if our barrenness of gold should secure us from invaders.

"Lastly, I must refer to my recent visit to the United States, at the invitation of the American Society for Testing Materials, the Society of Automotive Engineers, and the American Petroleum Institute. The reception I received was a clear manifestation of the bonds of friendship which unite the two great nations. We can claim brotherhood with our friends in the United States, and triumph in the generosity of the sentiment.

"In civilized society all things are linked together. When one branch of human thought has been set in motion other branches follow, and a general action ensues. Therefore, if we do our technical parts honestly and successfully, we can be assured that the leaders and guardians of the industry will do theirs."

"The Petroleum Industry"

Sir William Palmer, K.B.E., C.B. (Chairman of the Oil Consumers' Council), proposing the toast of "The Petroleum Industry," said:

"The first impression of the petroleum industry is of the immense size to which it has grown and the rapid rate at which it is growing. Production has nearly doubled since pre-war days, and it seems to me that there is a fair prospect that in ten years hence the present world industry will seem to have been quite small.

"For so modern an industry one or two things have surprised me. In the first place you do not know where your material comes from. You have not decided whether it is of vegetable or animal origin. That perhaps is why it is frequently referred to as mineral oil!

"A snag about your statistics is that besides looking round the edges of the tables to find out how many noughts have been omitted it is also necessary to find out whether the units are tons or barrels. I suspect that this is a proof of the predominance of the English-speaking races in the petroleum industry. Perhaps some long time ago someone put oil into barrels, and then there was some convenience in using the barrel as a measure. Now some arithmetician puts himself to a lot of trouble in converting a more regular unit of measure into barrels because he does not like to throw over the old traditions.

"But the student is also very impressed, not only by the growing uses of petroleum as fuel in various forms, but also by the many other by ways that you are making into the national life. What will not soon be based on petroleum? The waxes and the bitumens are I expect amongst the oldest products. We all know that much synthetic rubber is made from petroleum derivatives, and that your products turn up in paints, plastics, insecticides, disinfectants, and in hosts of other chemicals, and will wash clothes. Some years ago immense efforts were made to produce oil from coal. I have not heard that you have tried to produce coal from oil, but many of the characteristic coal-tar derivatives are now made from petroleum.

"All this is a good reason for toasting the petroleum industry as a matter of congratulation on its achievements. But of course the more the industry succeeds the greater are its responsibilities. Because of your success, Great Britain and many other countries are becoming very dependent on petroleum. We find little here. In the world production figures, the U.K. output appears at best well after the decimal point, whether in tons or in barrels and often only as a footnote. This is not because it has not been looked for here, but it does mean that the task of our petroleum industry is made heavier as our oil must be sought over the world, generally in most inconvenient places, and brought here in one form or another.

"I have no doubt that the petroleum industry has to keep its wits about it. There are not only the obstacles presented by nature but the possibly still greater obstacles created by man. It may be, Sir, that it is not always possible for the petroleum industry to achieve the ambition of all sensible men and steer clear of politics.

"It is therefore fortunate for Britain that we have an energetic petroleum industry; we should indeed be in a sorry plight if our oil supplies failed us. Whether we belong to the industry or not, we have very good reasons to hope for the success of its operations.

"No doubt many of you have wondered why I have been given the honour of proposing this toast. I am the Chairman of the Oil Consumers' Council, a body set up by the Minister of Fuel and Power, and consisting in the main of experts in the use of or the production and supply of petroleum. Its duty is to deal to the best of its ability with any matters that may be troubling the consumers of oil.

"The consumer is no doubt a bit of a nuisance. He is always either wanting more (at any rate, I, as a very private

motorist, do) or wanting it different. But he is essential. Even the petroleum industry cannot get on without him or prosper unless he prospers; neither the one nor the other will obtain the fullest advantage of the relationship between them without a full understanding of the causes of the innumerable difficulties that we encounter in our business lives. Hence in my view the Oil Consumers' Council has a function which can be very helpful to both sides. The consumers explain the nature of their troubles clearly and sincerely and the oil industry representatives, Mr Merrick and Mr Sinclair explain the causes of the troubles equally clearly and distinctly, as well as the prospects of their removals. At the same time we have the immense benefit of your President's wise and always helpful advice.

"The petroleum industry requires all the support Britain can give it in carrying out its responsibilities throughout the world, and if we can add our mite to the confidence of Britain in the industry we shall have done useful work. It is in that spirit that I ask you to drink to the toast of the petroleum industry coupled with the name of Sir Frederick Godber."

Sir Frederick Godber (Chairman and Managing Director, Shell Transport & Trading Co. Ltd.), responding, said:

"I must congratulate Sir William Palmer on his interesting and very able speech, but I feel I must at once say that he put me into the position of being able to correct one of his statements.

"Were he right in saying that consumers are always a nuisance, how should we be thinking of their eminent Chairman? I hasten to assure Sir William that he invited an entirely wrong conclusion there.

"He has shown an obvious knowledge of our industry, and yet there were gaps in that knowledge. For instance, his list of our waxes and fuels and chemicals should have included an essential lubricant—the one which I think is most responsible for the industry's progress. I refer to 'elbow grease.'

"Sir William's historical research—his linking of oil and coal—has brought to my mind that that association is not new; and as 1950 is its centenary year I would like to recall it.

"One of the first milestones of the industry's advance was reached in 1850 when a chemist discovered that by applying heat to coal and purifying the liquid thus produced, a satisfactory lamp oil of not very good quality by modern standards could be obtained. That so-called 'coal oil' revolutionized the lighting of our homes; and no-one can doubt that it was the resulting demand for more and better lights which stimulated the industry to seek extra sources to satisfy its consumers.

"Needless to say, that enterprising chemist was a Scotsman—James Young. I am sure all the Scotsmen present remember that—but even the rest of us can console ourselves with a modicum of pride because it was four years after this British discovery that a similar and independent one was made in Canada and still another five years had to pass before the American, Drake, pioneered the first petroleum well.

"Great advances have since been made in our industry, and yet I dare to prophesy that we have far to go before we find oil's maximum uses. We are now only on the fringe of them.

"But, Gentlemen, the toast so delightfully proposed by Sir William Palmer was to 'The Petroleum Industry.' For some, that brief title of our business may still conjure up imaginary thoughts of immense power or intrigue — or visions of an exclusive club for a few lucky giants. In fact, however, no picture could be more inaccurate. The petroleum industry to-day is a title of which many can be proud because it fits a business which advances only through the constant exertions of its many different parts. As a matter for the record, I may perhaps disclose that

at two refineries now being built in Britain, no less than 497 British firms are contributing to the construction (applause). The responsibilities of each differ, but none of us can speak of 'achievement' in the sense to which Sir William paid it tribute until every one of the 497 has completed its equally essential part.

"I could not even try to respond to Sir William's most handsome tribute to our industry unless I knew I had the privilege of speaking for it in that very much wider sense.

"On all your behalf then I will endorse every word he said about the need for and the benefits of full understanding between our industry and those who use its products and services; and whilst this evening we are thinking primarily of the United Kingdom consumers, I must in passing remind you of that much wider and more complex group of consumers overseas, for it is to the great wide world that the British industry caters. I like consumers. At times, as Sir William has said, they can be a nuisance, but at other times they would be our best friends. What would be the use of spending millions on pipelines, refineries, and distribution organizations if we had not a solid consumer element behind us? I say that, so long as the Consumers' Council are prepared to meet, if only once a quarter, and then for only five minutes at a time, they will get all the support they need from the industry—and more.

"Whichever side of the counter one is, one does need the other fellow's understanding before claiming his confidence. In this direction I am certain the petroleum industry has made substantial progress in recent years. But, if that is true I must also acknowledge our debt to all the agencies (such as this Institute, the American Petroleum Institute—and I emphasize that—our officials who have shown much understanding, and, not least, the Press). All have contributed so much to promote that better understanding.

"However, our customers' confidence has always proved a spur to extra effort. It was that extra effort that spurred our people to play a part in exploring and developing the resources of many other countries—to the benefit of the producing countries themselves and to the cause of international trade; no small factor, I have always maintained, in the promotion of international relationships.

"And yet, Gentlemen, though our responsibilities are heavy, they are always discharged by the criterion of plain commercial practice and ungarnished economic truth—not always palatable, but none the less very necessary. Every businessman knows there are no alternatives.

"And that prompts me to take up just one more remark of Sir William's. He suggested that our industry may not always be able to steer clear of politics. I say we do—though naturally there are times when a commodity of such great importance as petroleum cannot escape becoming the subject of public governmental discussion. The present issue between Great Britain and the United States illustrates my point. The issue is fundamentally one of international currencies (not petroleum)—a world economic problem between governments and governments. That the issue should at present centre about petroleum is largely incidental—it could quite easily have been some other commodity —and I am certain there is no oil man who does not regard that as unfortunate. I am sure the only wish of all in the industry is to be left alone with a full sense of our responsbility in world affairs to get on with our own jobs. Under such conditions (and governments need not be afraid) our individual enterprises are constantly stimulated by the free competition of all-comers and by our duty to all consumers—to their benefit and ours.

"Again I thank Sir William Palmer for his generous toast" (applause).

THIRD WORLD PETROLEUM CONGRESS

The Third World Petroleum Congress will be held in The Hague from May 28 to June 6, 1951, and a provisional programme has recently been issued by the Organizing Committee in Holland.

As on the two previous occasions, this Congress will deal with the whole field of petroleum technology, including economics and statistics. For classification purposes, the subjects have been grouped into ten master sections and various sub-sections, and the National Committees in each participating country are responsible for the collection of suitable papers.

The British National Committee, of which the President of the Institute of Petroleum is Chairman, has appointed reporters for each of the main sections, and the latter have undertaken the collection of papers from the U.K. in their respective sections, as in the following list:

Section 1. *Geology, Geophysics.* Prof. V. C. Illing, F.R.S., 15, Throgmorton Avenue, London, E.C.2; R. Davies, Anglo-Iranian Oil Co. Ltd., Britannic House, Finsbury Circus, E.C.2.

Section 2. *Drilling, Production.* E. Cooper Scott, Trinidad Leaseholds Ltd., Trinidad House, 29/30, Old Burlington Street, London, W.1; D. Comins, Anglo-Iranian Oil Co., Britannic House, Finsbury Circus, E.C.2.

Section 3. *Physical Operations in Oil Processing.* F. Mackley, "Shell" Refining & Marketing Co. Ltd., Stanlow Refinery, Ellesmere Port, Wirral, Cheshire.

Section 4. *Oil Processing Involving Chemical Conversions.* R. B. Southall, National Oil Refineries Ltd., Britannic House, Llandarcy, Neath, Glam.

Section 5. *Production of Chemicals from Petroleum, their Properties and Applications.* E. J. Dunstan, Manchester Oil Refinery Ltd., Twining Road, Trafford Park, Manchester 17.

Section 6. *Measurement and Control: Analysis and Testing.* W. H. Thomas, Anglo-Iranian Oil Co. Ltd., Chertsey Road, Sunbury-on-Thames, Middx.

Section 7. *Utilization of Oil Products.* C. S. Windebank, Esso Development Co. Ltd., Brettenham House, Lancaster Place, London, W.C.2.

Section 8. *Construction of Equipment, Materials, Corrosion.* E. J. Sturgess, Shell Petroleum Co. Ltd., St. Helen's Court, Great St. Helen's, London, E.C.3.

Section 9. *Transport, Storage and Distribution.* H. Hyams, Shell Petroleum Co. Ltd., Norman House, Strand, W.C.2.

Section 10. *Economics and Statistics. Documentation.* O. F. Thompson, Shell Petroleum Co. Ltd., St. Helen's Court, Gt. St. Helen's, London, E.C.3.

Only a limited number of papers can be adequately dealt with and discussed in the space of just over a week during which the Congress will be held, and some selection of available material may be necessary. Those who wish to submit papers for presentation are therefore invited to send particulars to the reporter dealing with the section in which the prospective paper would fall; this should be done as soon as possible and in any case not later than May 15, 1950. The preliminary information should include, besides the title and authorship, a brief synopsis indicating the subject matter and scope of the contribution. Completed manuscripts of accepted contributions must be received not later than the end of October 1950.

THE FUTURE OF BRITISH CIVIL AIRCRAFT AND THEIR POWER UNITS*

By AIR COMMODORE F. R. BANKS, C.B., O.B.E.

In 1939, at the beginning of the recent war, Great Britain had no basic type of passenger aircraft which could be further developed—with the possible exception of the flying boat!

We had nothing like the American Douglas DC.2 and DC.3 machines, which were the forerunners of the present all-metal monoplane types now operating the air routes of the world.

Some years before the war, the Handley-Page company had built a large four-engined biplane—the HP42—which gave safe and reliable operation. But it was very slow and was rendered obsolete by the American developments.

In the Short Empire flying boat we had an aircraft which was competitive with any of the same type, in the world.

The Armstrong-Whitworth Company had built two monoplanes before the war, the Atalanta and the Ensign. Both these were high wing monoplanes and the latter, particularly, would have shown considerable promise but for its engines, which were under-powered. Some Ensigns were, however, flying in the Middle East during the war, but these were fitted with more powerful (American) engines.

Since Britain's war effort was practically 100 per cent of her industrial capacity, it was not possible to develop further civil aircraft types during the war; and, when the United States entered the war, it was agreed that she should supply the requirements of her Allies in regard to necessary transport aircraft. This resulted in many thousands of the Douglas DC.3 being built which, as a military transport, was known as the Dakota. Large numbers of the DC.4 and the Curtiss Commando were also built.

Whilst nothing could be done actively, to develop new British passenger aircraft, plans were made for the types required for the future. In 1942, or thereabouts, a Government Departmental Committee, headed by Lord Brabazon, was formed to investigate the probable post-war requirements of British airline operating corporations and, finally, to recommend the types of aircraft to meet these requirements. This Committee's deliberations resulted in recommendations for various types of aircraft to operate the routes radiating from Britain.

These recommendations were not all acted upon, but some of the results are now to be seen in the Bristol Brabazon I, the Saunders-Roe Princess flying boat, the Vickers Viscount, the Armstrong-Whitworth Apollo, the De Havilland Comet, and the Airspeed Ambassador.

The Brabazon

The Brabazon I, Mark II, with propellor turbines, has been designed to cross the North Atlantic non-stop, from London to New York, with, I estimate, a round figure of about 100 passengers. Originally, it was decided that this machine should have piston engines but, later, it was proposed to fit propellor turbines because a higher cruising speed was required, particularly for the westbound crossing against strong headwinds. The present piston engines would have given too low a speed on that crossing and the cruising speed should now be somewhat over 300 m.p.h. in still air.

It will be appreciated, therefore, that the Brabazon model now flying, with piston engines, is not to be the final

*Summary of an address to the Oil Industries Club, November 1, 1949.

passenger-carrying aircraft but is, rather, a prototype for proving aerodynamic design and handling qualities.

The present machine is fitted with eight Centaurus engines, each having a take-off power of about 2,500 b.h.p., giving a total power of 20,000 b.h.p. An increase, of approximately 250 b.h.p. per engine, is possible with water/methanol injection or a fuel of higher knock rating, for take-off.

The Mark II version will have eight propellor turbines, each equivalent to about 4,000 h.p., raising the total power to 32,000 h.p. These engines are to be coupled (in pairs), to drive contra-rotating propellors.

Fully laden for the Atlantic crossing, the total weight of the Brabazon will not be far short of 300,000 lb.

Lancastrian and York

Before discussing the other interesting machines, it should be remarked that two aircraft were built during the war years, by A. V. Roe, to meet our own urgent transport demands, additional to the American aircraft already being used. These two machines, the Lancastrian and the York, were "drawing board" aircraft. That is to say, the basic Lancaster wing was taken and, in the case of the Lancastrian, a modified bomber fuselage was used with the passengers sitting along one side of the fuselage length. The York had a newly-designed but somewhat slab-sided fuselage, with normal seating.

These aircraft have given good service, during and since the war, and have been flown intensively for many millions of passenger miles, but they could not be said to represent the acme of comfort!

The Viking

Another important aircraft was the Vickers Viking, another machine built quickly towards the end of the war, and one which needed the minimum of development. Its fuselage was of entirely new design but followed standard practice so far as its internal arrangements and fittings were concerned. In the first place, the Viking used the fabric-covered Wellington wing and had a tail of Warwick design. But, later, all-metal wings were fitted and the tail surfaces were also cleaned up. The usual teething troubles were encountered, but the Viking is now giving very good service.

The Princess

Reverting now to the more modern aircraft, there is being built by Saunders-Roe, at Cowes, a very large high performance passenger flying boat. This machine, the Princess, has an all-up weight of well over 300,000 lb and is to be fitted with ten Bristol Proteus propellor turbines, similar in type to those proposed for the Brabazon I, Mark II. Eight of these engines will be coupled in pairs, driving contra-rotating propellors, and there will be a separate Proteus engine fitted at the outboard position on each wing.

Cruising speed will be 335 m.p.h. at an altitude of 35,000 ft, with approximately 100 passengers.

Viscount and Apollo

Now we come to two much smaller aircraft, the Vickers Viscount and the Armstrong-Whitworth Apollo. These have been designed for an effective range of about 1,000 miles and, in actual practice, they will probably operate in the 250- to 900-mile range.

The Viscount has already had quite a number of hours test flying and is showing every promise of being an excellent machine. The Apollo has just started its flight trials.

Both aircraft, in their present form, have an all-up weight of less than 50,000 lb. The Viscount is powered by four Rolls-Royce Dart propellor turbines, each of about 1,250 h.p. and the Apollo is fitted with four Mamba propellor turbines of roughly the same power.

The cruising speed of both will be in the region of 300 m.p.h. at an altitude of 20,000 to 25,000 ft.

The origin of the Dart and Mamba engines may be of interest. Towards the end of the war, it was evident that the R.A.F. would eventually have to be re-equipped with a new training machine, to take the place of the North American Harvard Trainer which was in general use during the war. The authorities decided that the new type should be fitted with a propellor turbine. It was my responsibility in M.A.P., at the time, to see to the development and ordering of such engines. Although it was not possible to guarantee a brand-new propellor turbine as quickly as an airframe of this type could be made, it was obvious that a propellor turbine of about 1,000 h.p. would also meet the requirements of the Brabazon Committee for a four-engined aircraft of about 50,000 lb all-up weight. Therefore, orders were placed with Rolls-Royce and Armstrong-Siddeley to produce similar engines, in competition. The result in each case has been most satisfactory and the Dart and Mamba engines are more than competitive with anything built outside Great Britain.

The Ambassador

The Airspeed Ambassador is a twin-engined aircraft powered by two Bristol Centaurus engines, and has an all-up weight of about 52,000 lb. A number have already been ordered, and some consideration has also been given to the replacement of the present piston engines by propellor turbines.

The Comet

In the De Havilland Comet we have an outstanding machine and the first civil type jet aircraft to be designed for particular airline requirements. It is powered with four D.H. Ghost engines, each of 5,000 lb static thrust at sea level. The all-up weight of the machine is in excess of 100,000 lb and its still-air range should be in the region of 3,000 miles at an operating height of 40,000 ft and a speed of about 500 m.p.h.

The Comet is a courageous attempt by a first-class firm to get ahead in this new form of air transportation; and De Havilland are to be congratulated on being, literally, the first in the field. Naturally, many will follow their lead but it takes courage to be the first to build such an almost futuristic aircraft. Many problems have to be solved—not the least being that of air-conditioning the cabin for the safety and comfort of more than 30 passengers and the crew, at an operating altitude of 40,000 ft. There is also the important question of the effect of "bumps" on the passengers, when flying at a speed almost twice that of present aircraft.

In addition, there is the problem of the traffic control of jet aircraft, immediate to the homing or arrival airport. Apart from its high speed, the jet-engined machine will have very little reserve fuel at its maximum range of operation and, therefore, it cannot be held off or long delayed in landing once it has arrived over the airport. On short trips, particularly, it will also be necessary to know the exact time of take-off from the airport of departure, in order that the aircraft can be almost immediately landed upon arrival.

Some have said that the traffic control for handling jet aircraft must first be altered before such machines are put on the routes. It is my opinion that little can be done until the air traffic control people are actually faced with the problem. In other words, jet aircraft must be flown on the routes, experimentally, before the traffic control system can be modified to meet their particular requirements.

The XC.102

An interesting jet machine has been built by A. V. Roe in Canada which is smaller than the Comet and is fitted with four Rolls-Royce Derwent-5

engines, each of 3,500 lb static thrust at sea level. This aircraft, the XC.102, has been specifically designed for operation on the Canadian routes of T.C.A. and is, therefore, of relatively short range compared with the Comet. It will have a cruising speed around 400 m.p.h.

Noise Level

There has been much interest regarding the noise level in propellor turbine and jet engined aircraft. Although the specialists can assess noise level, in terms of decibels, it is difficult to judge particular type of noise that will irritate the individual.

For instance, the comparative silence of the modern automobile has disclosed the fact that passengers can get very irritated by an odd squeak in the body or, even, the noise which the air makes around the ventilating windows.

One can conceive, therefore, that if an aircraft is similarly silenced, the individual passenger may become irritated with the conversation of his fellow passengers!

Both aircraft can be made, relatively, very silent in the cabin. But, from investigations made so far, the most important single factor in passenger comfort is the elimination of vibration. Lack of vibration in turbine engined aircraft is expected to help enormously in reducing the fatigue of passengers on long journeys.

In the case of the propellor turbine, there will be little or no noise resulting from the exhaust because, unlike the jet, there is little energy left in the exhaust gases. There is, of course, some propellor and reduction gear noise but this can be dealt with by soundproofing the cabin in line with the propellors.

In the case of the pure jet, the principal source of noise here is the jet discharge itself and it may be necessary to place the passenger accommodation ahead of the jet pipe exit. Although a very high pitched whine is heard from the superchargers of some jet engines, when standing outside the machine, this is not markedly apparent within the aircraft and when in flight.

Since most jet aircraft—and even those having propellor turbines—fly at relatively high speed, they are naturally "clean" aircraft, without any unnecessary excrescences. Therefore, it is not expected that there will be undue noise resulting from local air disturbance around the centre section and fuselage of such machines.

The propellor-turbined aircraft in which I have flown have been remarkably quiet, and the noise level is better than that of the average railway carriage. For instance, one can converse in the main cabin of the Viscount without raising one's voice above normal pitch. There is so little discernible vibration that, in calm air, it is possible to balance a pencil on end and a penny on edge in the cabin.

Fuel Requirements

On the question of fuel, particularly for those gas turbines fitted in civil aircraft, we have, at last, an engine which need not use a gasoline type fuel of high vapour pressure, i.e. from 5 to 7 lb Reid. Therefore, it is to be hoped that there will be sufficient of the present aviation kerosine to meet the future world requirements of civil aviation, when a large number of turbine-engined aircraft are flying.

For military purposes, it may be necessary to use a fuel of somewhat higher vapour pressure than kerosine, the vapour pressure of which is fractional. Even in this case there appears no reason for anything much higher than 1 to 2 lb Reid, although such a fuel would probably be synthesized and, for military use, would have a freezing point of minus 70°F. The freezing point of present aviation kerosine is minus 40°F.

A 1- to 2-lb Reid fuel would also be suitable for civil aviation purposes if,

eventually, there were insufficient kerosine to go round.

One of the present difficulties experienced with the aviation gas turbine, particularly of the jet variety, concerns its re-lighting at altitude. That is to say, if an engine has been stopped for one reason or another, it has been difficult to ignite the fuel and start the engine at altitudes in excess of 20,000 ft. In this respect gasoline has been shown somewhat superior to kerosine, by a few thousand feet in re-lighting altitude. However, the results of recent experiments have indicated that this need not be considered a fundamental difficulty, and successful re-lights have been obtained at 40,000 ft and above. But, where satisfactory ignition of the fuel has been obtained in those combustion cans fitted with ignitors, it has not been found easy to propagate the flame from these cans to the others. Therefore, some difficulty has been experienced in getting the engine to accelerate from its starting speed, which is in the region of 1,500 to 1,800 r.p.m.

There is little question, however, that these problems will be satisfactorily solved, although one would suggest that the annular type combustion chamber, when properly developed, might make for an easier solution.

In the case of civil aviation, particularly, it is most important that the operating life of the engine, between overhaul periods, should be as long as possible. In any case, the *target* should be not less than 1,000 hours of running time before maintenance becomes necessary. Any shorter period than this would be acceptable only if the engine had certain other attributes, such as an unusually high power/weight ratio and exceedingly low fuel consumption—the latter being the more important.

The operating period of a well-developed piston engine of moderately high specific power output, as exemplified by British and American air-cooled radial engines, is already beyond the 1,000 hours mark and, in fact, some engines have been cleared for 1,100 and 1,200 hours' operation.

This is to be expected from the American engines in airline service, since the same, or very similar, basic types have been on the job for many years. However, in Britain, and within the relatively short period since the war, engines such as the Bristol Hercules are already cleared for 800 hours' operation and are under observation for eventual clearance to 1,000 hours and over.

In the case of the gas turbine, whether it be a propellor turbine or turbo jet, there is no fundamental reason why similar operating periods cannot be obtained. In fact, there is every reason to believe that they will be obtained, once sufficient experience has been built up, in airline service, with a number of aircraft. Tests have already been made with both types of gas turbine, on the bench and in flying test beds and, in the case of the former, 500 hours of cyclic tests—to a test schedule representing flight operating conditions—have shown that the gas turbine is potentially every bit as reliable as the piston engine. In fact, it requires less attention than the latter between runs.

To be fair to the piston engine, however, it is the many years' experience with this type of engine that has made possible the rapid practical development of the gas turbine.

The experience of the R.A.F., to date, with turbo jets, is that less hours are spent on the ground in the maintenance of the engine and the airframe than with piston-engined aircraft, and a smaller personnel is required.

It will, naturally, be queried as to whether we are wise in "putting all our eggs in one basket" and concentrating upon the gas turbine to the virtual exclusion of the piston engine. But if you consider the position of Britain

at the end of the war, with nothing but make-shift aircraft, and America as the only possible source of immediate supply of modern (piston engined) aircraft, it is quite obvious that it would have been a waste of time to repeat what had already been well done in the U.S. Therefore, with our lead in gas turbine technology, our future policy was clear—we had to beat the rest of the world with turbine engined aircraft of outstanding performance.

You will now ask if the Americans can build a similar machine to the Comet. The answer is—"Yes, of course they can." There is no reason why firms such as Boeing, Douglas, and Lockheed cannot design and build a jet-engined aircraft, and there is already a British engine available in the U.S.—the Rolls-Royce Nene, built under licence by Pratt & Whitney.

But the British, through the far-sightedness of the De Havilland Company, have got there first and, if the Comet is the success it promises to be, then we are at least three years' ahead of our American friends.

The difficulty in building such aircraft in America to-day is that a good deal of money has already been spent by the firms in question and the U.S. airlines are re-equipping with machines such as the DC-6, the Convair and the Stratocruiser. And, since the obsolescence of such aircraft is usually not less than seven years, it would take considerable courage and a lot more money to embark upon the design and construction of an advanced prototype jet aircraft.

There is, however, the "Prototype Bill." The intention behind the framing of this Bill is that the American aircraft companies will receive financial support from the Government to build approved prototype aircraft—thus avoiding the almost crippling cost of the large modern prototype falling entirely upon the individual firm. However, the American aircraft manufacturers are very chary of the Bill and are frightened that it might prove the "thin end of the wedge" to the bureaucratic control of the industry.

Finally, it is safe to say that we are, to-day, ahead of the world in the practical flying of civil aircraft of advanced design, fitted with gas turbines. But this is not the time to sit back. We must continue to push forward and put yet more advanced types on the drawing board *now*, because there is little doubt that the Americans will soon produce some competitive turbine engined aircraft. Should they do this, they will at least have some advanced British designs to study beforehand—which all helps!

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PERSONAL NOTES

Lt.-Col. S. J. M. Auld, O.B.E., M.C., F.Inst.Pet. (*Past-President*), has been awarded the 1949 silver medal of the Institute of Marine Engineers. This medal is awarded annually for the best paper by a non-member and the paper concerned is that on "Principles of diesel lubrication," the co-author of which was C. Lawrie, and which appeared in the July issue of the Transactions of the Institute of Marine Engineers.

M. T. Cowles, M.Inst.Pet., has recently taken up a new appointment as general manager of the Western Australian Branch of Vacuum Oil Co. Pty. Ltd. He asks his many friends in the U.K. to note his new address—115 St. George's Terrace, Perth, W.A.—and will also be pleased to hear from other members in his area.

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Tractor Lubrication. A new lubrication chart, which may be obtained from local divisional offices of Shell-Mex and B.P., has been produced in respect of the Nuffield Universal Tractor (Models M3 and M4).

AROUND THE BRANCHES

FAWLEY, LONDON, NORTHERN, SCOTTISH, SOUTH WALES, STANLOW, TRINIDAD

Fawley Branch

The meeting on December 14, at the Esso Recreation Club, Holbury, was well attended, there being 49 members and 46 visitors present. Speaker was G. B. McGuire, resident engineer-in-charge of the construction of Fawley refinery and his subject was "Refinery Construction."

Mr McGuire described the problems which are encountered in different localities and illustrated his points by reference to the type of work already under way at Fawley.

Some refineries are built on marshy ground; others on rocky terrain and in every case problems peculiar to the locality have to be overcome in the initial site preparation. The speaker stressed the importance of safety precautions for personnel during construction.

He described the great part that is played in cost accounting in providing a check on the efficiency for the construction programme in all its phases. The techniques used in foundation work and steel erection were also described and the lecturer pointed out the necessity of correct integration of work between the various sections of construction.

In conclusion, the methods of testing the completed equipment were detailed.

The meeting showed great appreciation of Mr McGuire's talk and Mr G. Noble, the Chairman, in his concluding remarks said that the lecturer had painted so vivid a picture that he thought for the moment that the refinery had been built before he had had time to train the operators.

Dr F. Mayo proposed a vote of thanks to the speaker which was seconded by Mr R. Wilkinson.

"The gas turbine as a power unit for aircraft" was the subject of the talk given to the Fawley branch on January 18, the lecturer being K. C. Hunt, assistant manager of the Technical Sales department of the Anglo-American Oil Co. After training at the City and Guilds College as an engineer, Mr Hunt spent five years in various sections of the motor car industry. He entered the Anglo organization in 1937 and spent ten years specializing in the marketing and technical aspects of supplies to the aviation industry.

Mr Hunt started his address by showing a film which described the principles of the gas turbine. He then gave a most interesting talk, illustrated by slides, in which he discussed the various features of the design of the gas turbine engine and the type of fuel which the petroleum industry was called upon to supply for the running of these prime movers.

At the conclusion, the audience numbering 49 members and 27 visitors showed their keen appreciation of the address by a large number of questions.

London Branch

On the evening of February 22, a record gathering for the London Branch, of 165 members and visitors arrived at Manson House to hear Mr C. M. Merrick, managing director of Shell-Mex and B.P. Ltd., and Chairman of the United Kingdom Petroleum Advisory Committee, give a paper on "Distribution and Marketing in the U.K."—the fourth of the series on "Petroleum Today" in the Branch's current session.

In introducing Mr Merrick, the Chairman, A. J. Goodfellow, referred to his exalted position in the industry and said how sensible the Branch was of the honour done to it by Mr Merrick's willingness to prepare and deliver such a paper.

Mr Merrick divided his address into three parts, starting with a historical review of the U.K. petroleum industry and then describing the details of the process of distribution of various products. The last part of the paper was a very interesting review of the highly specialized features and problems of the marketing of the various products of petroleum, and ended with a description of the U.K. price structure and the impact of government control of prices and distribution.

After a short discussion, during which the war-time pipeline system and the question of dealer *versus* company-operated service stations were touched upon, J. L. Taylor, newly-elected to the Branch committee, proposed a vote of thanks which was carried with acclamation. A number of members then went to the Bolivar Restaurant where Mr Merrick was the guest at an informal dinner.

London Branch A.G.M. and Supper

With the creditable attendance of 47 members, the Annual General Meeting of the London Branch opened at Manson House on the evening of January 25. The Chairman, A. J. Goodfellow, presented his report on the activities and progress of the Branch during the past year, which had been an active and successful one, as shown by the membership which stood at 292, a 30 per cent increase in the year.

The results of the ballot for three vacancies on the Committee for 1951 were announced; H. G. Spence, J. L. Taylor and N. E. Walters were elected.

Following the A.G.M., the Institute's president, E. A. Evans, presented a paper entitled "Motor Racing." The paper, accompanied by a number of lantern slides, gave a most interesting survey of the history of the great international motor races, showing very clearly how design had altered and progressed through the years, under the influence of ever-increasing speeds and severity of conditions, and aided by constant improvements in the lubricants and fuels available.

After Mr Evans' paper, for which he was accorded a very hearty vote of thanks, a film called "Grand Prix" was shown which, after some sequences of early races, told in detail the story of a modern Grand Prix road race.

The Branch had taken advantage of the occasion to arrange a supper at which the President was the guest of honour. L. Pomeroy proposed the toast of "The Institute of Petroleum" in a witty speech in which he praised the influence of a body such as the Institute in maintaining and improving the standards of products made available to users such as the motor industry, in which he himself had particular experience.

The President's reply to the toast took the form of an eloquent tribute to the work done in getting the London Branch started and so firmly set on the road of progress, mentioning specially the efforts of the two chief architects of that success, the Chairman and Secretary of the Branch. The President saw this evening as, in a sense, a celebration of achievement.

G. H. Thornley in proposing the toast of "The London Branch" dealt briefly with the value of the branches as an adjunct to the parent Institute, and stressed the pleasure felt by the Branches Committee in the sound progress achieved by the London Branch.

The Chairman, A. J. Goodfellow, replied to the toast and began by reviewing the growth of the Branch from the first meeting in 1946, attended by 21 people, to to-day's membership at almost 300—and still growing. The principal object of the Branch was to help the ordinary non-technical or semi-technical man to a wider understanding of his part in the great industry in which he was engaged. The results seemed to show that this object was being achieved; but only through the efforts of many people to whom much grati-

tude was due, including the Council and Branches Committee of the Institute, no less than the committee of the Branch, past and present. The Chairman then expressed the hope that all Branch members would keep in mind an ambition to progress in due course to corporate membership of the parent Institute and concluded by foreshadowing his own retirement from the chair.

R. D. Streeton then proposed the toast of "The Visitors," to which George Sell responded.

South Wales Branch

On January 5 at Britannic House, Llandarcy, Colonel R. E. Strong of the Thornton Research Centre, Chester, delivered a paper entitled "Operational Research."

This was in the form of a general discussion covering all aspects of any industry and as such, although not directly concerned with the petroleum industry, was of considerable interest. Colonel Strong introduced his subject by reference to the applications made in the armed forces during the war, which led up to the development and activities in various industries. Described as a scientific method used to study operations as distinct from laboratory experiments, operational research requires for its use: numerical data, some degree of repetition and some facilities for controlled experiment. The performance and qualities of most things can be expressed in figures; its development in simple statistical methods has enabled operational research to be used in various fields and industries.

After giving examples of its use, Colonel Strong dealt with organization and administrative conditions. As stated by the speaker, in delivering this paper to an audience connected with the petroleum industry, the purpose was to provide material for discussion, as no report of operational research under that name seems yet to have come from this industry.

In this Colonel Strong succeeded and an interesting discussion followed.

Trinidad Branch

Several interesting meetings are scheduled for the current session. Speaker at the March/April meeting, on "Absorption," is to be Dr A. L. Down. At the June/July meeting J. M. Tait is to speak on "The turn-round of refinery units."

Among the autumn Branch activities are a visit to a Trinidad Brewery and Glass Works, while at another meeting J. L. Deal, M.A., is to speak on "Absorption of gases on charcoal."

SPRING GOLF MEETING

It has been decided to amalgamate the I.P. Golf Meeting with the Oil Industries Club Golfing Society Spring Meeting, at Walton Heath, Surrey, on Wednesday, May 17, 1950.

This should prove to be a very enjoyable event, as even the Americans regard Walton Heath as one of the best inland courses in the world, and there should be a large entry for this combined competition.

The "Dalley" Cup, played for in the morning, is for the Oil Industries Club members only, but the sweeps will be open to all, and also the prizes. Players may enter in couples, or partners will be found.

In the afternoon, foursomes are played for prizes and sweeps, and all partners and opponents are drawn.

The total cost will be 25s. per player, which includes green fees, lunch, tea, sweeps and gratuities. Entries should be sent to the General Secretary of the Institute of Petroleum not later than May 8, 1950.

Competitors are asked to indicate whether they require a caddie (£1 per day, payable to the caddiemaster), and if they require a partner for the morning round, starting time from 9.30 a.m.

Cheque for £1 5s. should be sent with the entry, also lowest club handicap.

SIGNIFICANCE OF PROPERTIES OF PETROLEUM PRODUCTS

X. ENGINE TESTING OF LUBRICANTS

By J. ATKINSON (Assoc. Fellow)

In the United States, the Co-ordinating Research Council Inc. (C.R.C.), formed in 1942 jointly by the American Petroleum Institute and the Society of Automotive Engineers, Inc., has published a series of engine oil test procedures which has attained a wide measure of acceptance and official recognition. In Britain, similar test procedures have not yet been standardized, and the standard methods book of the Institute of Petroleum does not include engine tests for lubricating oils. Oil companies, research associations, and some engine manufacturers do, however, operate their own particular engine oil tests which in their separate opinions are considered capable of evaluating oil performances.

In the absence of British standard methods, enumeration of widely accepted American oil test procedures, and properties which they seek to evaluate, serves to show the general aims of oil testing. Thus it can be stated that oils for use in either gasoline or diesel engines are required to exhibit all the various properties to different degrees. U.S. methods which are described in the 1946 Handbook of the C.R.C. are used for qualifying lubricants for service in army ground-force vehicles (U.S. Army Specification 2-104B). Similar types of engine oil test methods are used for qualifying oils for U.S. Navy Service (U.S. Navy Specification 14-0-13a). The difference between U.S. Navy and U.S. Army specifications is brought about by the desire of the U.S. Navy to test oils also under conditions specific to marine application.

C.R.C. tests were standardized in the U.S. during World War II because of:

The intention of the U.S. Army to use, for all internal-combustion engines, an improved type of oil meeting a single specification (viz., additive-type oils, commonly referred to as heavy duty oils). Recognition that engine lubricants supplied to U.S. Services should be tested, not only in the laboratory, as hitherto practised, but also in engines because the properties of such lubricants could not suitably be evaluated in glassware or in rig tests.

H.D. oils were developed as alternatives to non-additive type oils which were found to perform inadequately in some of the new engines introduced prior to and during the early part of the last war.

Some diesel engine manufacturers figured prominently in the development of engine oil test procedures published by the C.R.C., notably the Caterpillar Co. and General Motors Corporation, since they required engine tests which would enable them to select oils suitable for their engines.

Desirable Properties of Lubricating Oils

The designation of the C.R.C. tests and the properties which they principally evaluate are:

CRC-L-545.

Caterpillar diesel engine.
Piston ring-sticking, wear and accumulation of deposits.

CRC-L-2-545.

Caterpillar diesel engine.
Piston ring and/or cylinder liner scratching under conditions of accelerated run-in and full load. (This test is optional and is not now usually employed by the U.S. Army for approval of 2-104B oils.)

CRC-L-3-545.

Caterpillar diesel engine.
High temperature oil stability, bearing corrosion (copper-lead).

CRC-L-4-545.

Chevrolet gasoline engine.
Oxidation stability, bearing corrosion, deposit formation, lacquering and sludge formation of heavy-duty oils.

CRC-L-5-545.

G.M.C. diesel engine.
Oxidation stability, ring-sticking, detergency, bearing corrosion of heavy-duty oils.

Since the C.R.C. tests were standardized, other test procedures have been developed, both in the U.S. and the U.K. Some of the new procedures are capable of assessing, in improved ways, properties already referred to; whilst others are capable of evaluating slightly different aspects of performance from those originally described in the C.R.C. Handbook. Such changes in methods of test are necessitated by: a better general understanding of lubrication requirements of internal-combustion engines, changes in types of fuels available, increased demands on oil performance, and by lubrication requirements of newer designs of engines being different from the requirements of existing engines.

For instance, whereas none of the C.R.C. tests evaluates oil performance, either under low-temperature operating conditions, or when used in conjunction with high-sulphur fuels (i.e., 1 per cent wt S or over) such tests have been developed recently both in the U.S. and U.K.

Evaluation of Oil Performances

Certain aspects of oil performance such as wear, bearing corrosion and deposit formation, can be measured quantitatively. Other aspects such as piston cleanliness, lacquer and crankcase sludge, are often measured qualitatively by comparison with previously acquired standards of reference, such as a range of pistons in which each piston exhibits a different standard of cleanliness (i.e., lacquer or sludge formation). Again performance can be assessed by means of merit or demerit ratings of engine cleanliness, determined according to given formulæ, account being taken of deposit formation in respect of location, thickness, nature, and magnitude of areas covered with deposits.

In some types of test, oils are evaluated in terms of performance of specific reference oils. The same reference oils may be used also to standardize engine performance, and thus serve to measure tests repeatability and reproducibility. This practice applies in the case of the C.R.C. L-4-545 test, and in the Bristol Hercules R.G.2 ring-gumming test of D.E.D.2472 Specification which was developed in the U.K. during the late war for testing aviation oils. In other types of test, performance requirements are specifically defined, and oils are required only to pass the tests in question, i.e., they are not placed in order of merit. Such a test may be described as a "go/no-go" test. This obtains in the case of the C.R.C. L-1-545 test. In such cases the particular test procedure is usually designed to simulate certain field-operating conditions, such that oils which prove satisfactory in this type of bench-test can be expected to perform satisfactorily under similar conditions in the field.

In order to evaluate oil performance it is not only necessary to exercise control over the preparation and operation of test engines before and during test and subsequent inspection, but to control fuel quality as well, since lack of attention to this factor can have considerable effect upon test results. The necessity for such care is demonstrated by the fact that gasoline intended for use in the Chevrolet engine, in the C.R.C. L-4-545 test, has not only to conform to certain restrictive requirements, such as lead content, distillation range and sulphur content, but also, when used in conjunction with certain specified reference oils, must produce test results which fall within certain defined limits. The extent to which this type of pre-

caution is necessary depends largely upon the type and sensitivity of test.

Ring-sticking

In bench tests the onset of ring-sticking is usually recognized by excessive changes in piston blowby, cylinder-barrel temperatures, or rate of oil consumption. In spite of the different indications, however, it is still difficult to determine just when ring-sticking occurs. For this reason it is essential to replicate ring-sticking tests and it is convenient therefore to arrange for tests to be of reasonably short duration (e.g., 50 hr). This can usually be accomplished by suitable choice of operating conditions.

Two typical types of test are generally employed, namely those of variable duration, and constant duration.

In tests of the first type, oil performance may be expressed in terms of the test duration necessary to cause ring-sticking to occur, whereas in tests of the second type, the cylinder barrel temperature required to cause ring-sticking to just take place in the fixed duration of test may be used as the criterion of oil performance.

If knowledge exists of the maximum and/or minimum ring-groove temperatures which prevail in engines suffering from ring-sticking in the field it may be possible to apply, more usefully, knowledge gained from the second type of test rather than the first type. However, in general it is very difficult to obtain precise information of this nature. Moreover operating conditions are extremely variable. Thus the test of variable duration is perhaps more useful since it enables one to determine how much shorter or longer a given oil will run compared with reference oils, and in this way performance is expressed in practical terms.

Ring-sticking can occur in all types of gasoline and diesel engines, the latter being particularly prone to it. In each type of engine, the effect is principally caused by oxidation and deterioration products derived from combustion of fuel and lubricating oil being deposited in ring grooves and restricting the normal movement of piston rings in their grooves, thus impairing their gas-sealing properties. In diesel engines, however, in addition to exhibiting adequate oxidation stability, necessary in aviation and motor oils, the lubricant should be capable of preventing the much larger quantities of "soot," normally associated with diesel engine combustion, from restricting ring movement by being deposited in piston ring grooves and causing "ring packing." The property required to fulfil this function is commonly referred to as detergency. In practice "sooty," or incomplete combustion prevails when fuel injectors are faulty and when engines run on overload.

Wear, Corrosion and Sludging

The principal types of wear which are recognized are: abrasive wear, which is caused chiefly by dust-laden atmosphere but can occur also owing to rupture of the oil film irrespective of whether combustion air is dust laden or not, and corrosive wear, which is caused mainly by acids formed during the combustion process.

Abrasive wear can take place so long as air required for combustion and crankcase ventilation is inadequately cleaned, and so long as crankcases are contaminated with abrasive materials. Reduction of this type of wear is, therefore, dependent upon efficient air and oil filtration and not on oil development.

Corrosive wear can occur under low-temperature operating conditions which allow condensation of water of combustion and the formation of corrosive acids. The upper limit of this low-temperature range of coolant temperatures is approximately 60°C at outlet. Under adverse conditions corrosion can take place during both operating and idle periods. The relative merits of

different oils, in terms of this property are therefore reflected in the extent to which each oil is capable of preventing or delaying the onset of corrosion. In this respect straight mineral oils hardly differ between themselves and considerable improvements in oil performance can only be expected from the use of suitable additives. In spite of recognition of two principal types of wear, in practice both types usually occur simultaneously and moreover promote each other mutually. It is therefore possible only to say that in a particular circumstance wear is principally corrosive or principally abrasive.

Tests which evaluate corrosive wear are sometimes capable also of assessing crankcase corrosion and low-temperature sludging since the same types of operating condition can produce the three effects.

Bearing Corrosion

Bearing corrosion tests are principally carried out using copper-lead bearings since this type of bearing is liable to corrosive attack. Because of their suitable mechanical properties such bearings are frequently encountered in various makes of internal-combustion engine. A typical bearing corrosion test is the C.R.C. L-4-545 test, performed in the Chevrolet engine. The method requires special copper-lead test bearings to be fitted to two of the six connecting rods (large-end) and that the test should operate for 36 hr at a high oil temperature (137°C). Performance is assessed in terms of weight loss per whole bearing.

The satisfactory performance of copper-lead bearings in respect of corrosion may become of less importance in the future, since aluminium alloy bearings are now available for use with the higher bearing pressures and temperatures. In many engines, however, white-metal bearings are still used and while these do not normally suffer from corrosion, they are liable to fatigue failure under higher load conditions.

Some Comments upon the Significance of Oil Tests

In this short review attention has been focused chiefly, upon effects produced in engines rather than in lubricating oils because the state of engines, and not that of the oil, is of chief importance to operators. Upon considering the significance of engine tests it is important to realize that each type of test evaluates the performance of oils only under the particular operating conditions used and does not necessarily predict field performance. On the other hand, oils which perform well in widely different types of bench test are quite likely to perform well in the field, but because a number of oils can be placed in a given order of merit in one or more laboratory test it does not necessarily follow that they will always rank in the same order in the field; superior properties which one oil may exhibit, as opposed to another, may not be required in the type of field service in which they are being compared. Oil performance can be influenced also by each of the following factors: types of operating conditions, which differ appreciably from one type of service to another; differences in engine design, differences between the engine maintenance practices of different operators.

Thus, some opinions concerning the significance of engine oil tests are likely to be influenced by knowledge of the above factors, and of the application for which a given product is formulated (e.g., aviation, diesel, or automobile service).

In general, therefore, different types of engine oil test cannot be classified in order of importance. Each type performs a useful function, and is used as demanded by the particular properties of a given product. Ultimately, the relative effectiveness of bench tests is reflected in the way in which each test evaluates properties known to be required in service in the field. This factor in turn calls for proper diagnosis of field requirements.

In conclusion it should be mentioned that the Engine Tests of Lubricants Panel of the Institute of Petroleum, is interested in establishing in the U.K. standard engines and test procedures for evaluating engine lubricating oils. So far, two such engines have been designed and built, and have already passed preliminary acceptance tests. One of these, the Sunbury engine, is a gasoline engine which has been sponsored by the Anglo-Iranian Oil Co. Ltd. The other, the Shell-Ricardo engine, is a diesel engine which has been sponsored by Shell Petroleum Co. Ltd. Thus, some facilities have been provided for the development of standard oil test procedures in British engines, and the Institute of Petroleum provides a mechanism through which interested parties may collaborate.

SUGGESTIONS FOR FURTHER READING

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★ ★ ★

SEARCH FOR OIL IN QUEENSLAND

Preparations for the drilling of a deep test (Morella Well No. 1), which lies about 40 miles south of Rolleston in central Queensland, are now well advanced.

The erection of a 136 ft steel derrick with a capacity of 500 tons dead weight has been completed. Heavy drilling machinery imported from the United Kingdom has already been transferred from Brisbane via Rockhampton (about 700 miles by rail and road), and with the exception of about six heavy items is already at the well site. The total weight of materials involved is approximately 1000 tons. Landed value of the equipment and spares for the drilling of the deep test is more than £300,000.

A new camp to house Shell's 60-70 employees has been also built.

★ ★ ★

Kelloggram No. 1, 1950, describes the modernization of the Cities Service East Chicago oil refinery. Photographs show the construction of the modernized plant as well as the finished job. The booklet is available from M. W. Kellogg Co., 225 Broadway, New York, 7.

CORRESPONDENCE

To the Editor, *I.P. Review*

Dear Sir,

Recently I attended a lecture on "Environmental cancer and petroleum," given by Col. S. J. M. Auld, to the Institute's Northern Branch members.

This was indeed an interesting lecture.

Col. Auld gave a very lucid account of his subject which covered a wide ground including "Mule spinners cancer," cancer in the dye industry, cancer among chimney sweeps, and biological research experiments on animals in relation to carcinoma.

Discussion following such a talk was bound to be interesting and it was so.

Questions were asked as to whether carcinogenicity was likely to be caused in any way to the reaction of sulphur with certain compounds. Also, since the speaker had spoken mainly of the environment of cancer from contact, was there any information available as to vapour phase contamination being a cause of cancer?

It might be mentioned here that on the written authority of Prof. Dodds, M.V.O., F.R.S., the mechanism of cancer growth and its method of killing its victims are understood perfectly.[1]

The body consists of three types of tissues, ectoderm, mesoderm and endoderm. The ectoderm is the skin and external covering of the body; the mesoderm includes connective tissues, muscles, tendons and so forth, and the endoderm represents the lining of the digestive tract and the ancillary systems connected with it. Normally these tissues grow in an orderly manner and produce a perfectly functioning body. If the malignant process is initiated in any part of the body associated with these three types of tissue, the cells begin to multiply in an irregular manner.

Thus, if an ectoderm cancer is produced, the cells multiply and produce a swelling on the surface of the skin. The cells then break through the skin and invade the mesoderm, and pieces of this growth are broken off and are transported by either the blood or the lymph stream and stick in other parts of the body. Here they continue to grow in the same irregular manner and the result is another cancer.

It is interesting to note the ways in which, according to Prof. Dodds, cancer may be produced in the body.

These are:—

1. By the application or administration of external agents.
2. By transplantations of tumours from one animal to another.
3. By injection of certain cell-free filtrates made from ground-up living tissue.
4. By some factor within the body itself.

Reading through these it would not appear that cancer is produced through any continued presence in a vaporous atmosphere.

However, many vapours, of which a good example in this case is benzene (since benzene ring compounds such as benzpyrene and β-naphthylamine are carcinogenic) can cause, over long periods of inhalation of low concentrations, damage to the blood, liver, or kidneys.[2]

Chronic benzene poisoning is characterized by changes in the blood which, if allowed to progress are irreversible.

Routine examination of the blood of all persons exposed to benzene vapour allows the detection of early changes in the white cells of the blood, so that removal from exposure may be arranged even before the patient himself notices any symptoms.

Col. Auld mentioned that certain animals such as rabbits and mice showed different reactions to research treatment under identical conditions. Whilst one became subject to carcinoma the other did not.

This would come under some factor within the body itself.

Under the relation that "Mule spinners cancer" which is due to con-

tinuous contact with oil, is caused by the carcinogenic agent benzpyrene; that in the dye industry, β-naphthylamine and benzidine are the agents; and that in the profession of chimney sweeping, soot can cause carcinoma of the scrotum, I ventured to suggest that as all these compounds contain a high percentage of carbon, some form of carbon itself might be mainly responsible for the origin of cancer.

It was further suggested that since X radiation can produce cancer could not a radioactive carbon be the cause, and it was asked if any work with radiocarbon isotopes as tracers had been known to show any signs of cancerous growth.

In this respect is it worthy of note that Prof. W. F. Libby, has found that all living things are in a small degree radioactive.[3]

By laboriously concentrating the radio carbon obtained in the form of methane from the Baltimore Sewage Works, Prof. Libby has been able to confirm that the predicted radioactivity of organic carbon is a real phenomenon.

The last question regarding the radioactivity of carbon as the initial cause of cancer may, as the speaker said, be imaginative reasoning, but such thoughts are worthy of expression, and may, coupled with the authoritative views of Professors Dodds and Libby, prove interesting reading for *I.P. Review* readers.

It is apparent that the process which originates cancer metabolism is not clearly understood, and that the problem of cancer appears no less complex after half a century of painful research; yet it is quite a possibility for someone working in an allied field, to stumble on a real clue to its solution.

Yours truly,

W. BOXALL.

15 Dalveen Avenue,
Davyhulme,
Manchester.

January 20, 1950.

1. *Science News* 13. "The problem of cancer." Prof. E. C. Dodds, M.V.O., F.R.S.
2. *Science News* 11. "Occupational health." Dr. T. A. Lloyd Davies.
3. *Science News* 6. "Physics front." A. W. Haslett.

★ ★ ★

SERVICING UNIT FOR VENEZUELA

The first high capacity truck-mounted oil well servicing unit to be designed and manufactured in the U.K. recently left London for Cabimas, near Lake Maracaibo, Venezuela. The unit, which has been painted olive green and grey, weighs approximately 25 tons. It comprises a double or single drum diesel hoist with a 64 ft telescoping tubular steel mast of 60,000 lb capacity, all mounted on a Leyland "Super Hippo" truck. Truck and hoist are each fitted with a Leyland 125 h.p. engine.

The hoist is rated for servicing wells up to 7,000 ft in depth and for carrying out workover jobs to 5,000 ft. A rotary table drive is provided for drilling up to 2,500 ft.

Nine more units of this type have been ordered by Shell for use in Venezuela, Indonesia, Trinidad and Egypt. The Woodfield Hoist Company of Rochester, Kent, are the manufacturers.

British oil well servicing hoist for Venezuela. The unit will operate at Cabimas, near Lake Maracaibo.

SECOND OIL SHALE AND CANNEL COAL CONFERENCE

Arrangements for the Second Oil Shale and Cannel Coal Conference which the Institute of Petroleum is holding in Glasgow during the period July 3–7, 1950, are making progress.

Details of the programme show that in the technical sessions nearly fifty papers will be presented. Every phase in the industry will be dealt with authoritatively by technicians and much valuable discussion should result.

In the section on Geology and Mining there will be a number of important contributions on modern and improved methods of winning the shale. In particular, the Bureau of Mines of the U.S. Department of the Interior is discussing the work on its experimental oil shale mine in Colorado, and information will be given concerning the Ljungstrom method of treating oil shale *in situ*.

Current practice in Australia, South Africa, France, etc., will also be described.

The Section on Retorting, Refining and Uses of By-Products, will bring up-to-date knowledge on the production of oil from the shale, and here again the U.S. Department of the Interior is giving details of its work on the Colorado shales, and on the oils obtained therefrom.

Methods used for the refining of shale oils in various countries will be discussed, and the chemistry and the utilization of the products will be dealt with in a number of papers.

Preprints of the papers will be available before the Conference only to those who have registered as members.

Several works visits have been arranged for members of the Conference and entertainment is also being organized for members and their ladies.

Registration fee is £1 1s. (10s. 6d. for ladies) and full details and forms are obtainable from the Hon. Secretary, W. M. Stirling, c/o Scottish Oils Ltd., Middleton Hall, Uphall, Broxburn, West Lothian. Those intending to join the Conference should register without delay.

DATA SHEETS ON FUELS, LUBRICANTS AND HYDRAULIC FLUIDS

The aim of these data sheets is to provide in a form convenient to aircraft and engine designers and users information on the physical and chemical properties of aviation fuels, lubricants, and hydraulic fluids. The data sheets on aviation fuels are now ready; those on lubricants and hydraulic fluids are being prepared.

The scope of the information required and its presentation in the form of data sheets have been the responsibility of the Fuels and Oils Sub-Committee of the Royal Aeronautical Society on which the Institute of Petroleum has been represented; collecting and analyzing the data has been done by the Aviation Products Data Committee of the Institute of Petroleum.

The group of data sheets on aviation fuels provides information on standard methods of test, a summary of the quality requirements of British and U.S. gasolines and distillate fuels, and a substantial body of data on their composition, vapour pressure, specific heat, viscosity, inflammability, etc. This group of sheets, seventeen in number and complete with folder, can be obtained by writing to either the Secrefary, the Royal Aeronautical Society, 4 Hamilton Place, London, W.1., or the Secretary, the Institute of Petroleum, 26 Portland Place, London, W.1. The price, including postage, is 23s. 6d. to members of the Society or the Institute, 35s. 6d. to non-members.

"FLEET OLD BOYS"

More than 50 retired masters and chief engineers of the Shell fleet of tankers have formed a "Fleet Old Boys' Association" which will forgather annually. Many of the retired officers of this merchant fleet have more than 30 years' service to their credit.

FORTHCOMING MEETINGS

INSTITUTE MEETINGS

The Application of Radioactive Tracer Technique to the Study of the Movement of Oil in Sands. S. E. Coomber and E. N. Tiratsoo. At 26 Portland Place, London, W.1, 5.30 p.m. (*tea* 5 *p.m.*), May 10.

FAWLEY BRANCH

Petroleum in Agriculture. F. Ellis. At Esso Recreation Club, Holbury, April 26.

LONDON BRANCH

Petroleum Today. The Long-Range Picture. D. Turner. At 26 Portland Place, London, W.1., 6 p.m. (*tea* 5.30 *p.m.*), April 20.

NORTHERN BRANCH

Motor Racing. E. A. Evans. At Engineers' Club, Albert Square, Manchester, 6.30 p.m., April 25.

SOUTH WALES BRANCH

Architecture and Its Applications. J. L. Smith. At Britannic House, Llandarcy, 5.30 p.m., April 13.

MEETINGS OF OTHER SOCIETIES

New Plants for Producing Chemicals from Oil in England. Institute of Fuel, at Institution of Mechanical Engineers, London, 5.30 p.m., April 26.

Catalysis and the Poisoning of Catalysts. E. B. Maxted, Society of Chemical Industry, at London School of Hygiene, Keppel St., W.C.1., 6.30 p.m., May 1.

Silicones. J. W. Barrett. Chemical Engineering Group. At Geological Society, London, 5.30 p.m., May 9.

★ ★ ★

"THE STORY OF OIL"

In a neat booklet of 52 pages the Burmah Oil Company (Pakistan Concessions) Ltd. has compressed the story of oil, beginning with biblical references to bitumen, through the early American strikes, down to present-day methods of production and distribution. A separate chapter, devoted to the search for oil in Pakistan, is illustrated by several photos of operations at Chakwal and Lakhra. The booklet is published by Burmah-Shell Publicity Dept., Karachi.

NEW FUNGICIDE

SR406 is an agricultural fungicide recently developed in Standard Oil Development Company's Esso Laboratories, in conjunction with Rutgers University. The material has been the subject of extensive field tests in the U.S.A. during the past three years and is currently being tested at agricultural research stations in Great Britain. The fungicide is said to be effective against a variety of diseases attacking fruit and vegetable crops.

★ ★ ★

Ring Balances. A new illustrated bulletin explains the workings of the Hagan Ring Balance Meters which, it is claimed, provide automatic compensation for pressure or temperature variations, or both, in flow measurement of gases or liquids. Copies from Hagan Corp., Hagan Building, Pittsburgh 30, Penn.

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HANDLEY PAGE MARATHON

A new type of airliner, the Handley Page Marathon, left London on January 14 on a 35,000 mile world demonstration flight, which is estimated will take about four months. The aircraft is powered by four de Havilland Gypsy Queen engines.

As an airliner, it will carry 22 passengers and their luggage for 500 miles at a cruising speed of between 160 and 210 miles per hour. As a freighter, the Marathon has a payload of more than 4,000 lb for the 500 miles range.

Fuelling arrangements at some 50 points on the Marathon's demonstration flight are in the hands of Shell. More than 140,000 gallons of aviation fuel and 1,500 gallons of oil are being supplied.

★ ★ ★

Coal Ash Analysis. The D.S.I.R's Fuel Research Survey Paper No. 50, entitled "Improved Methods for the Quantitative Analysis of Coal Ash and Coke Ash" revises many of the methods set out in Survey Paper No. 28, published in 1933. From H.M. Stationery Office, price 1s. 0d. (by post 1s. 2d.).

Glass-To-Metal Seals is the title of a new illustrated pamphlet produced by the producers of the "Nilo" series of low-expansion alloys, Henry Wiggin & Co. Ltd., Wiggin Street, Birmingham 16.

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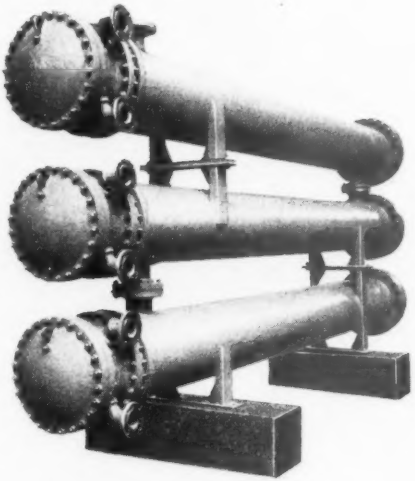

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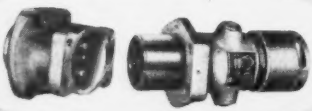

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